

REMARKS

Claim 1 has been amended to include the limitation that the once-through hydrogen-containing treat gas cascaded from the second reaction zone comprises all of the vapor product from the second reaction zone. No new matter has been added. Support for this amendment can be found on page 9, first full paragraph of the instant specification and in the Figure associated with the instant application.

Page 8 of the specification has been amended according to the Examiner's suggestions. Namely, the second "is" as it appears in the last full sentence of page 8 has been deleted. Also, the reference to the overhead vapor product stream as line "20" has been amended to refer to this stream with reference numeral "18"; this overhead vapor product stream is denoted as such in the attached Figure. No New matter was added.

Page 9 of the specification has also been amended according to the Examiner's suggestions. Namely, the misspelled term "reulting" has been replaced with "resulting" and "frist" has been replaced with "first". No New matter was added.

The Figure corresponding to the instant specification has also been amended according to the Examiner's suggestions. Namely, the reference number "R2" has been added to refer to the second reaction stage. No New matter was added.

OBJECTION TO THE SPECIFICATION

The Examiner has objected to the specification because of certain informalities.

EXAMINER'S POSITION

The Examiner points out that the specification on page 8 teaches that the vapor product stream is collected via overhead line 20 when the drawing gives this line

reference numeral "18". The Examiner also points out typographical errors in the specification.

APPLICANTS' POSITION

Applicants submit amended pages 8 and 9 herewith to correct all informalities and typographical errors pointed out by the Examiner. Namely, the second "is" as it appears in the last full sentence of page 8 has been deleted, and the misspelled term "reulting" has been replaced with "resulting" and "frist" has been replaced with "first". No New matter was added.

Applicants request that the Examiner withdraw these objections.

REJECTION UNDER 35 U.S.C. 103(a)

Claims 1-11 have been rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Number 5,114,562, Haun et al. ("Haun").

EXAMINER'S POSITION

It is the Examiner's position that Haun teaches a mineral oil conversion process that includes hydrodesulfurization and hydrogenation steps performed in separate reaction zone. The Examiner states that the subject invention specifically relates to the hydrogenation of distillate petroleum fractions to produce low sulfur content products including diesel and jet fuel and that the feedstock can include virtually any middle distillate. The Examiner states that while Haun differs from the instantly claimed invention in that Haun does not show a cocurrent flow of hydrogen and hydrocarbons through the reaction zones. The Examiner states that while Haun differs from the instantly claimed invention in that Haun does not show a process wherein the stripping gas is the vapor phase product from a second reaction stage, the process of Haun et al is

not limited to this manner of operation. The Examiner continues that a hydrogen-rich gas may flow countercurrent to the liquid-phase hydrocarbons through one or more reaction zones. The Examiner takes the position that it would have been obvious to one having ordinary skill in the art at the time the invention was made to use at least some of the vapor product from the second reaction stage as a stripping gas because Haun et al teach that the stripping gas and vapor phase product are both "hydrogen rich" gases.

APPLICANT'S POSITION

Applicants respectfully disagree with the Examiner. It is applicants' position that one having ordinary skill in the art and knowledge of Haun at the time the invention was made would not have found it obvious to arrive at the presently claimed invention.

As amended, the instant invention requires that the hydrogen-containing treat gas cascaded from the second reaction zone comprise the entire vapor product from the second reaction zone.

Haun does not teach this process configuration. Haun teaches that "A first portion of the hydrogen recovered from the second zone is recycled to the second zone", and "a second portion is passed to the first (desulfurization) zone." See Haun, col. 5, lines 13-21. Haun does not teach that its process can operate without recycling a portion of the gas from the second reaction zone to the second reaction zone. Haun teaches that "preferably from about 35 to 70 volume percent of this gas recovered from the second reaction zone, is passed to the first reaction zone... A remaining second portion is admixed with the gas of line 18 and passed into the treating zone for hydrogen sulfide removal." See Haun, col. 8, lines 18-25. It should be noted that this is an incorrect reference in the Haun patent since the line carrying this gas is given reference numeral 33 and reference numeral 18

denotes the vapors leaving separator 17. Line 18(33) of Haun is mixed with the vapor exiting separator 17 and is treated to remove H_2S in unit 21; this stream, line 22, is then mixed with the feed to reactor 23, the second reaction zone. See the Haun Figure. Thus, Haun teaches a recycle loop for the hydrogen gas used therein around the second reaction zone.

Further, Haun teaches that the liquid product resulting from the first reaction stage must be stripped in a stripping zone, denoted by reference numeral 12 in the Haun Figure. It is within this stripping zone that the fresh hydrogen for the Haun process is added. The stripping vapor containing this hydrogen is then separated in separator 17 and mixed with the portion of the vapor from the second reaction zone being recycled to the second reaction zone.

The instant invention does not add fresh hydrogen into a stripping zone nor use the vapor exiting a stripping zone anywhere within the reaction zones of the instantly claimed process flow scheme. While the instant invention does teach that a stripping zone may be employed after the separation zone between the first and second reaction zones, see page 8, second paragraph of the instant specification, there is no teaching to use this stripping gas in the second reaction zone.

Contrary to the teachings of Haun, the fresh hydrogen-containing treat gas used in the instantly claimed invention is introduced into the second reaction stage not a stripping zone. The present invention gains further efficiency by not requiring recycle of treat gas. See page 9, first paragraph of the instant invention.

Further, the instant invention claims the use of once-through hydrogen-containing treat gas, which is cascaded from the second reaction zone. This once-through hydrogen

containing treat gas comprises all of the vapor product exiting the second reaction zone. None of the vapor exiting the second reaction zone is used within a recycle loop around the second reaction zone as taught by Haun. The introduction of the fresh hydrogen-containing treat gas directly into the second stage reactor allows the second stage reactor "to be operated more efficiently owing to a reduction in the activity suppression on the catalyst exerted by H_2S and NH_3 and an increase in H_2 partial pressure." See page 9, first paragraph of the instant specification. The present invention also operates more efficiently by not requiring recycle of treat gas. See page 9, first paragraph of the instant invention.

It should also be noted that the instant invention is concerned with hydroprocessing of a hydrotreated distillate feedstock, as noted in the preamble to claim 1. This is neither taught nor suggested in Haun. The use of a previously hydrotreated distillate allows the instant invention to operate with relatively low treat gas rates.

Thus, it is applicants' position that Haun does not obviate the instantly claimed invention. Haun does not teach the use of once-through hydrogen-containing treat gas. On the contrary, Haun teaches a recycle loop around the second reactor disclosed therein. Also, Haun does not teach the addition of fresh hydrogen directly into the second reaction zone as presently claimed. Instead, Haun teaches to add fresh hydrogen into a stripping zone and use the vapor from the stripping zone, after H_2S removal and pressurization, along with a portion of the vapor product from the second reaction zone, as the treat gas in the second reaction zone. Haun also does not contemplate the use of a previously hydrotreated feedstock.

The Examiner is requested to reconsider and withdraw this rejection.

USSN 09/457,434
Atty. Docket No. HEN-9910

Based on the preceding arguments and amendments, the Examiner is requested to reconsider and withdraw all rejections and pass this application to allowance. The Examiner is encouraged to contact applicants' attorney should the Examiner wish to discuss this application further.

Respectfully submitted:

Date: 2-06-03



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MARKED-UP CLAIMS ACCOMPANYING RESPONSE TO OFFICE ACTION FOR USSN

09/457,434:

1. A two stage process for hydroprocessing a hydrotreated distillate feedstock which process comprises:

- a) reacting said feedstock in a first reaction stage in the presence of a once-through hydrogen-containing treat gas cascaded from the second reaction stage herein, said first reaction stage containing one or more reaction zones operated at hydrodesulfurization conditions wherein each reaction zone contains a bed of hydrotreating catalyst, and wherein said once-through hydrogen-containing treat gas cascaded from the second reaction stage comprises all of the vapor product from the second reaction zone;
- b) passing the resulting reactant to a separation zone wherein a vapor phase stream and a liquid phase stream are produced;
- c) collecting said vapor phase stream overhead; and
- d) passing said liquid phase stream to a second reaction stage in the presence of a hydrogen-containing treat gas, said reaction stage containing one or more reaction zones operated at aromatics saturation conditions wherein each reaction zone contains a bed of aromatics saturation catalyst, and wherein said hydrogen-containing treat gas is passed through said reaction stage countercurrent to the flow of said liquid phase stream.

**MARKED-UP PAGES 8 AND 9 OF THE SPECIFICATION SHOWING CHANGES MADE
ACCOMPANYING RESPONSE TO OFFICE ACTION FOR USSN 09/457,434**

mean that the percents are based on the weight of the support. For example, if the support were to weigh 100 g. then 20 wt.% Group VIII metal would mean that 20 g. of Group VIII metal was on the support. Typical hydrotreating temperatures range from about 100°C to about 400°C with pressures from about 50 psig to about 3,000 psig, preferably from about 50 psig to about 2,500 psig.

A combined liquid phase and vapor phase product stream exit reaction vessel R1 via line 16 and into separation zone S wherein a liquid phase product stream is separated from a vapor phase product stream. The liquid phase product stream will typically be one that has components boiling in the range from about 150°C to about 650°C, but will not have a boiling range greater than the feedstream. The vapor phase product stream is collected overhead via line ~~20~~ 18.

The liquid reaction product from separation zone S is passed to reaction vessel R2 via line 20 and is passed downwardly through the reaction zones 22a and 22b of reaction stage R2. Prior to being passed downwardly through reaction stage R2, said liquid reaction product stream can first be contacted in a stripping zone to remove entrapped vapor components from the liquid stream. For example, as the liquid product stream flows through the stripping zone, it is contacted by upflowing hydrogen-containing treat gas under conditions effective for transferring at least a portion of the feed impurities in the vapor into the liquid. The contacting means comprises any known vapor- liquid contacting means, such as rashig rings, berl saddles, wire mesh, ribbon, open honeycomb, gas-liquid contacting trays, such as bubble cap trays and other devices, etc.

Fresh hydrogen-containing treat gas is introduced into reaction stage R2 via line 24 and ~~is~~ passed in an upward direction counter to the flow of liquid reaction product. The introduction of clean treat gas (gas substantially free of H₂S

and NH_3) allows reaction stage R2 to be operated more efficiently owing to a reduction in the activity suppression effects on the catalyst exerted by H_2S and NH_3 and an increase in H_2 partial pressure. This type of two stage operation is particularly attractive for very deep removal of sulfur and nitrogen or when a more sensitive catalyst (i.e., hydrocracking, aromatic saturation, etc.) is used in the second reactor. Another advantage of the present invention is that the treat gas rate is relatively low compared with more conventional processes. The use of relatively low treat gas rates is primarily due to the use of previously hydrotreated distillate feedstocks. Further efficiencies are gained by not requiring recycle of treat gas.

The liquid/vapor separation step (S) may be a simple flash or may involve the addition of stripping steam or gas to improve the removal of H_2S and NH_3 . The liquid stream and treat gas are passed countercurrent to each other through one or more catalyst beds, or reaction zones, 22a and 22b. The ~~resulting~~ ^{resulting} liquid product stream exits reaction stage R2 via line 26, and a hydrogen-containing vapor product stream exits reaction stage R2 and is cascaded to reaction stage R1. Reaction stage R2 also contains non reaction zones 23a and 23b following each reaction zones. The catalyst in this second reaction stage is an aromatic saturation catalyst.

The figure also shows several options. For example, lines 30 and 32 can carry kerosene which can be used as a quench fluid. Also, a unsaturated feedstock can also be introduced into the ~~first~~ ^{first} reaction stage via line 28. The degree of unsaturation can be up to about 50 wt.%.

The reaction stages used in the practice of the present invention are operated at suitable temperatures and pressures for the desired reaction. For example, typical hydroprocessing temperatures will range from about 40°C to about

**REPLACEMENT PAGES 8 AND 9 OF THE SPECIFICATION ACCOMPANYING RESPONSE TO
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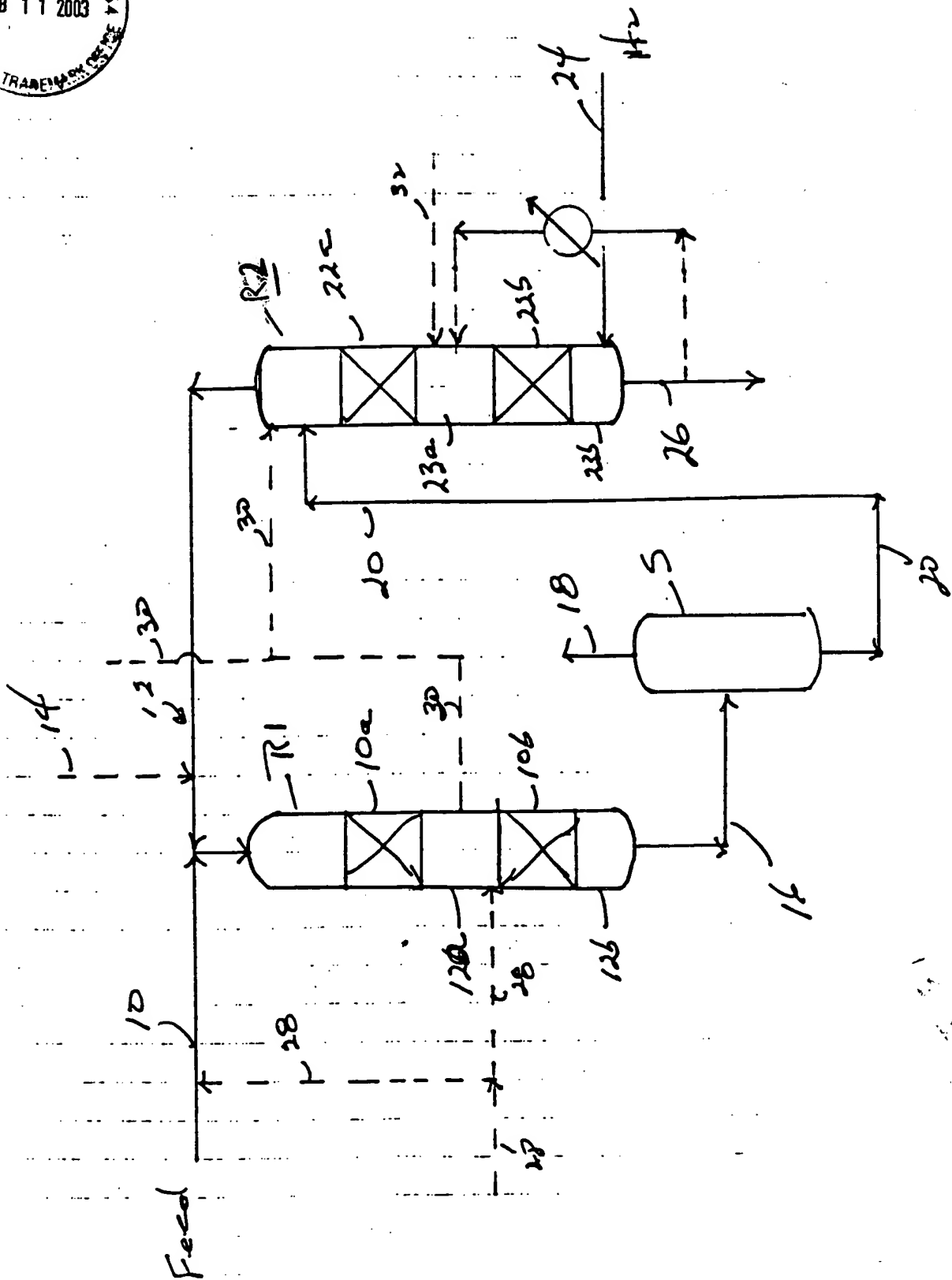
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REPLACEMENT FIGURE ACCOMPANYING RESPONSE TO OFFICE ACTION FOR USSN
09/457,434

